Claims

We Claim:

1. A method of reducing drag of a fluid comprising:

providing a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

adding to the fluid a drag reducing composition comprising an amount of an aluminum carboxylate effective to reduce the drag of the fluid, where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate.

2. The method of claim 1 where the aluminum carboxylate is an aluminum dicarboxylate.

3. The method of claim 1 where the aluminum carboxylate is selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof.

4. The method of claim 1 where the amount of aluminum carboxylate based on the total amount of fluid ranges from about 10 to 2000 ppm.

5. The method of claim 1 where the drag reducing composition further comprises a hydrocarbon solvent.

6. The method of claim 1 where the drag reducing composition is prepared by a process comprising reacting:

at least one aluminum monocarboxylate with

at least one carboxylic acid having from 6 to 54 carbon atoms to form an aluminum dicarboxylate drag reducing additive;

where the reacting is conducted prior to and/or simultaneously with the adding.

7. The method of claim 6 where the reaction is performed in the presence of a hydrocarbon solvent.

8. The method of claim 6 where the reaction is conducted at a temperature in the range of from about room temperature to about 350°F (about 25°C to about 177°C).

9. The method of claim 6 where the reaction and the addition of the drag reducing composition to the fluid are performed continuously.

10. The method of claim 1 where the drag reducing composition comprises a dispersion comprising from about 5 to about 50 vol% of at least one aluminum dicarboxylate and at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof.

11. The method of claim 10 where the dispersion has a viscosity ranging from about 20 to about 500,000 cP at 25°C.

12. The method of claim 10 where, in the dispersion, the solvent is paraffin oil having a viscosity of greater that about 20 centistokes at 40°C.

13. The method of claim 10 where the dispersion further comprises up to about 10 vol% of at least one co-solvent selected from the group consisting of alcohols, aromatic hydrocarbons, light hydrocarbons and mixtures thereof.

14. A method of reducing drag of a fluid comprising:

providing a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

adding to the fluid a drag reducing composition comprising from about 10 to 2000 ppm, based on the total amount of fluid, of an aluminum carboxylate selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof, where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate.

15. A method of reducing drag of a fluid comprising:

providing a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas;

reacting at a temperature in the range of from about room temperature to about 350°F (about 25°C to about 177°C):

at least one aluminum monocarboxylate made from a fatty acid having from 6 to 54 carbon atoms, with

at least one carboxylic acid having from 6 to 54 carbon atoms to form an aluminum dicarboxylate drag reducing additive; and

adding to the fluid an amount of the aluminum dicarboxylate drag reducing additive effective to reduce the drag of the fluid, where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate,

where the reacting is conducted prior to and/or simultaneously with the adding.

16. A method of reducing drag of a fluid comprising:

providing a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

adding to the fluid a drag reducing dispersion comprising from about 5 to about 50 vol% of at least one aluminum dicarboxylate and at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof, where the viscosity of the dispersion ranges from about 20 to about 500,000 cP at 25°C.

17. A reduced drag fluid comprising:

a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

a drag reducing composition comprising an amount of an aluminum carboxylate effective to reduce the drag of the fluid, where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate.

18. The reduced drag fluid of claim 17 where the aluminum carboxylate is an aluminum dicarboxylate.

19. The reduced drag fluid of claim 17 where the aluminum carboxylate is selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof.

20. The reduced drag fluid of claim 17 where the amount of aluminum carboxylate based on the total amount of reduced drag fluid ranges from about 1 to 100 ppm.

21. The reduced drag fluid of claim 17 further comprising a hydrocarbon solvent.

22. The reduced drag fluid of claim 17 where the drag reducing composition is made by a process comprising reacting:

at least one aluminum monocarboxylate with

at least one carboxylic acid having from 6 to 54 carbon atoms to form an aluminum dicarboxylate drag reducing additive.

23. The reduced drag fluid of claim 22 where the reaction is performed in the presence of a hydrocarbon solvent.

24. The reduced drag fluid of claim 22 where the reaction is conducted at a temperature in the range of from about room temperature to about 350°F (about 25°C to about 177°C).

25. The reduced drag fluid of claim 17 where the drag reducing composition comprises a dispersion comprising from about 5 to about 50 vol% of at least one aluminum dicarboxylate and at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof,

26. The reduced drag fluid of claim 25 where the dispersion has a viscosity ranging from about 20 to about 500,000 cP at 25°C.

27. The reduced drag fluid of claim 25 where in the dispersion the solvent is paraffin oil having a viscosity of greater that about 20 centistokes at 40°C.

28. The reduced drag fluid of claim 25 where the dispersion further comprises up to about 10 vol% of at least one co-solvent selected from the group consisting of alcohols, aromatic hydrocarbons, light hydrocarbons and mixtures thereof.

29. A reduced drag fluid comprising:

a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

a drag reducing composition comprising from about 10 to 2000 ppm, based on the total amount of fluid, of an aluminum carboxylate selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof, where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate.

30. A reduced drag fluid comprising:

a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas;

an amount of an aluminum carboxylate drag reducing additive effective to reduce the drag of the fluid, where the additive is prepared by reacting:

at least one aluminum monocarboxylate made from a fatty acid having from 6 to 54 carbon atoms, with

at least one carboxylic acid having from 6 to 54 carbon atoms to form an aluminum dicarboxylate drag reducing additive

at a temperature in the range of from about room temperature to about 350°F (about 25°C to about 177°C)

where the bulk fluid viscosity of the fluid is not increased by the aluminum carboxylate.

31. A reduced drag fluid comprising:

a fluid selected from the group consisting of hydrocarbons, mixtures of hydrocarbons and water, and mixtures of hydrocarbons, water and gas; and

a drag reducing dispersion comprising from about 5 to about 50 vol% of at least one aluminum dicarboxylate and at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof, where the viscosity of the dispersion ranges from about 20 to about 500,000 cP at 25°C.

32. A drag reducing dispersion composition comprising:

from about 5 to about 50 vol% of at least one aluminum dicarboxylate, and

at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof.

33. The drag reducing dispersion composition of claim 32 where the viscosity of the dispersion composition ranges from about 20 to about 500,000 cP.

34. The drag reducing dispersion composition of claim 32 where the solvent is paraffin oil having a viscosity of greater that about 20 centistokes at 40°C.

35. The drag reducing dispersion composition of claim 32 further comprising up to about 10 vol% of at least one co-solvent selected from the group consisting of alcohols, aromatic hydrocarbons, light hydrocarbons and mixtures thereof.

36. The drag reducing dispersion composition of claim 32 where the aluminum dicarboxylate is selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof.

37. A drag reducing dispersion composition comprising:

from about 5 to about 50 vol% of at least one aluminum dicarboxylate selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof, and

at least one solvent that is a paraffin oil having a viscosity of greater than about 20 centistokes at 40°C and mixtures thereof,

where the viscosity of the dispersion composition ranges from about 20 to about 500,000 cP.

38. A method of making a drag reducing dispersion composition comprising:

combining in any sequence components comprising:

at least one aluminum monocarboxylate;

at least one carboxylic acid having from 6 to 54 carbon atoms; and

at least one solvent selected from the group consisting of paraffin oils, fatty acid esters, glycols, diglycols, polyglycols, low molecular weight poly(alpha-olefins), and mixtures thereof; and

mixing the components to form a suspension of at least one aluminum dicarboxylate in the solvent.

39. The method of claim 38 where the aluminum monocarboxylate and the carboxylic acid are first reacted together prior to combining with the at least one solvent.

40. The method of claim 38 where the viscosity of the dispersion composition ranges from about 20 to about 500,000 cP.

41. The method of claim 38 where the solvent is paraffin oil having a viscosity of greater that about 20 centistokes at 40°C.

42. The method of claim 38 where the combining the components further comprises up to about 10 vol% of at least one co-solvent selected from the group consisting of alcohols, aromatic hydrocarbons or light hydrocarbons.

43. The method of claim 38 where the aluminum dicarboxylate is selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof.

44. A method of making a drag reducing dispersion composition comprising:

combining in any sequence components comprising:

at least one aluminum monocarboxylate selected from the group consisting of aluminum dioctoate, aluminum distearate, aluminum octoateoleate, aluminum octoatestearate, aluminum stearateoleate, hydroxyaluminum bis-(2-ethylhexanoate), and mixtures thereof;

at least one carboxylic acid having from 6 to 54 carbon atoms; and

at least one solvent that is a paraffin oil having a viscosity of greater that about 20 centistokes at 40°C; and

mixing the components to form a suspension of at least one aluminum dicarboxylate in the solvent,

where the viscosity of the dispersion composition ranges from about 20 to about 500,000 cP.